

WHAT IS CLAIMED IS:

1. A semiconductor device comprising:

a semiconductor element;

a flexible substrate having at least one electrode pad and surrounding said semiconductor element;

a conductor for connecting said semiconductor element with said electrode pad; and

a plurality of solder bumps on said electrode pad;

wherein at least a first portion between a surface of said semiconductor element facing said solder bumps and said flexible substrate is not fixed by adhesion.
2. The semiconductor device according to claim 1,

wherein a second portion between a side surface of said semiconductor element and said flexible substrate is not fixed by adhesion.
3. The semiconductor device according to claim 2,

wherein said first portion is smaller than all the area of said surface of said semiconductor element facing said solder bumps.
4. The semiconductor device according to claim 2,

wherein about the center of said surface of said semiconductor element facing said solder bumps of said semiconductor element is fixed to said flexible substrate by adhesion.
5. The semiconductor device according to claim 3,

wherein about the center of said surface of said semiconductor element facing said solder bumps is fixed said flexible substrate by adhesion.

6. The semiconductor device according to claim 1,
wherein said first portion is smaller than all the area of said surface of said semiconductor element facing said solder bumps.

7. The semiconductor device according to claim 1,
wherein said first portion is larger than 1/2 of all the area of said surface of said semiconductor element facing said solder bumps.

8. The semiconductor device according to claim 1,
wherein about the center of said surface of said semiconductor element facing said solder bumps is fixed said flexible substrate by adhesion.

9. The semiconductor device according to claim 1,
wherein said flexible substrate includes two insulating resin films and an intermediate layer for forming a wiring pattern.

10. The semiconductor device according to claim 9,
wherein at least one of said insulating resin films nearer to said semiconductor element is made of thermoplastics resin.

11. A semiconductor device comprising:
 - a semiconductor element;
 - a flexible substrate having at least one electrode pad and surrounding said semiconductor element; and
 - a conductor for connecting said semiconductor element with said electrode pad;
 - a plurality of solder bumps on said electrode pad; and
 - a plate between a surface of said semiconductor element facing said solder bumps and said flexible substrate.
12. The semiconductor device according to claim 11,
 - wherein said plate is not fixed said semiconductor element by adhesion.
13. The semiconductor device according to claim 11,
 - further comprising a non-adhesive agent between a side surface of said semiconductor element and said flexible substrate.
14. The semiconductor device according to claim 13,
 - wherein the area of said plate is smaller than that of all said surface of said semiconductor element facing said solder bumps.
15. The semiconductor device according to claim 13,

wherein about the center of said surface of said semiconductor element facing said solder bumps is fixed said flexible substrate by adhesion.

16. The semiconductor device according to claim 14,

wherein about the center of said surface of said semiconductor element facing said solder bumps is fixed said flexible substrate by adhesion.

17. The semiconductor device according to claim 11,

wherein the area of said plate is larger than 1/2 of all the area of said surface of said semiconductor element facing said solder bumps.

18. The semiconductor device according to claim 11,

wherein the area of said plate is smaller than that said surface of said semiconductor element facing said solder bumps.

19. The semiconductor device according to claim 11,

wherein about the center said surface of said semiconductor element facing said solder bumps is fixed to said flexible substrate by adhesion.

20. The semiconductor device according to claim 11,

wherein said flexible substrate includes two insulating resin films and an intermediate layer for forming a wiring pattern.

21. The semiconductor device according to claim 20,
wherein at least one of said insulating resin films nearer to said semiconductor element is made of thermoplastics resin.
22. The semiconductor device according to claim 11,
wherein a rate of a linear expansion of said plate is equal to that of an external substrate on which said semiconductor device is mounted, or between that of said semiconductor device and that of said external substrate.
23. A semiconductor device comprising:
a semiconductor element;
a flexible substrate having at least one electrode pad and surrounding said semiconductor element;
a conductor for connecting said semiconductor element with said electrode pad; and
further comprising means for relieving a thermal stress between said semiconductor element and an external substrate on which said semiconductor device is mounted.
24. A semiconductor device comprising:
a plurality of a semiconductor device stacked and mounted on an external substrate,
wherein at least the lowermost semiconductor device is a semiconductor device according to claim 1.

25. A semiconductor device comprising:
a plurality of a semiconductor device stacked and mounted on an external substrate,
wherein at least the lowermost semiconductor device is a semiconductor device
according to claim 11.
26. An electronic apparatus comprising a semiconductor device according to claim 1.
27. An electronic apparatus comprising a semiconductor device according to claim 11.
28. A semiconductor device manufacturing method comprising:
providing a semiconductor element;
providing a flexible substrate including two insulating resin films and an intermediate
layer for forming a wiring pattern;
opening a hole for an electrode pad in said insulating resin of said flexible substrate;
forming said electrode pad connecting to said wiring pattern;
connecting said electrode pad to said semiconductor element via a conductor;
bending said flexible substrate along said semiconductor element;
forming a plurality of solder bumps on said electrode pad; and
fixing by adhesion said flexible substrate and said semiconductor element other than at
least a first portion between a surface of said semiconductor element facing said solder bumps
and said flexible substrate.

29. The semiconductor device manufacturing method according to claim 28,
wherein said first portion is made by applying a mold lubricant or a non-adhesive agent to a desired region of said surface of said semiconductor element facing said solder bumps or of the inner insulating resin film of said flexible substrate.
30. The semiconductor device manufacturing method according to claim 28,
wherein said first portion is made by exposing a desired region of the inner insulating resin film of said flexible substrate to plasma for surface modification treatment.
31. The semiconductor device manufacturing method according to claim 28, further comprising:
providing said semiconductor element and said flexible substrate on a stage having holes;
vacuuming through said holes and fixing semiconductor element and said flexible substrate on said stage.
32. A semiconductor device manufacturing method comprising:
providing a semiconductor element;
providing a flexible substrate including two insulating resin films and an intermediate layer for forming a wiring pattern;
opening a hole for an electrode pad in said insulating resin of said flexible substrate;
forming said electrode pad connecting to said wiring pattern;

connecting said electrode pad to said semiconductor element via a conductor;
providing a plate on said semiconductor element;
step for preventing said plate from shifting from its position;
bending said flexible substrate along said semiconductor element;
fixing by adhesion said flexible substrate and said semiconductor element; and
forming a plurality of solder bumps on said electrode pad in the side nearer to said plate.

33. The semiconductor device manufacturing method according to claim 32,
wherein said step of preventing said plate from shifting from its position comprises
applying pressure to said plate.

34. The semiconductor device manufacturing method according to claim 32,
wherein said step of preventing said plate from shifting from its position includes:
providing a temporary adhesive on said semiconductor element and fixing said
semiconductor element and said plate temporarily; and
losing said adhesion after the step of fixing by adhesion the flexible substrate, the
semiconductor element, and the flat plate to one another.

35. The semiconductor device manufacturing method according to claim 32, further
comprising:
providing said semiconductor element and said flexible substrate on a stage having holes;

vacuuming through said holes and fixing said semiconductor element and said flexible substrate on said stage.

36. A semiconductor device manufacturing apparatus comprising:
a stage for placing a semiconductor device;
a roller for pressurizing a surface of the semiconductor device on the stage,
wherein the surface of said stage has holes for fixing said semiconductor device on said stage by vacuuming through said holes.
37. The semiconductor device manufacturing apparatus according to claim 36,
wherein said stage and roller have heating members.
38. The semiconductor device manufacturing apparatus according to claim 36,
wherein said stage is made of a porous material.
39. The semiconductor device manufacturing apparatus according to claim 36,
further comprising means for controlling a stress of pressurizing the surface of the semiconductor device.
40. The semiconductor device manufacturing apparatus according to claim 36,
wherein a diameter of said holes is larger than a diameter of solder balls mounted on said semiconductor device.

41. A semiconductor device manufacturing apparatus comprising:
a stage for placing a semiconductor device;
a roller for pressurizing the surface of the semiconductor device on the stage, and
a pressurizing device for pressurizing said semiconductor device.
42. The semiconductor device manufacturing apparatus according to claim 41,
wherein said pressurizing device can move up and down according to the movement of
said roller.
43. The semiconductor device manufacturing apparatus according to claim 41,
wherein at least a surface of said pressurizing device is made of an elastic and heat-
resistant material.
44. The semiconductor device manufacturing apparatus according to claim 36,
wherein a groove is formed in the center or the outermost perimeter of said stage.
45. The semiconductor device manufacturing apparatus according to claim 36,
wherein a height of said stage at the center thereof is greater than a height of said stage at
an edge thereof.
46. The semiconductor device manufacturing apparatus according to claim 45,

wherein the surface of said stage is made of a shape-memory material.

47. The semiconductor device manufacturing apparatus according to claim 36,
further comprising a heater for heating said semiconductor device without contacting said semiconductor device.

48. The semiconductor device manufacturing apparatus according to claim 36,
wherein the surface of said stage is processed so as to render the surface non-adhesive.

49. The semiconductor device according to claim 12,
wherein a rate of a linear expansion of said plate is equal to that of an external substrate on which said semiconductor device is mounted, or between that of said semiconductor device and that of said external substrate.

50. The semiconductor device according to claim 13,
wherein a rate of a linear expansion of said plate is equal to that of an external substrate on which said semiconductor device is mounted, or between that of said semiconductor device and that of said external substrate.

51. The semiconductor device according to claim 14,

wherein a rate of a linear expansion of said plate is equal to that of an external substrate on which said semiconductor device is mounted, or between that of said semiconductor device and that of said external substrate.

52. The semiconductor device according to claim 15,

wherein a rate of a linear expansion of said plate is equal to that of an external substrate on which said semiconductor device is mounted, or between that of said semiconductor device and that of said external substrate.

53. The semiconductor device according to claim 16,

wherein a rate of a linear expansion of said plate is equal to that of an external substrate on which said semiconductor device is mounted, or between that of said semiconductor device and that of said external substrate.

54. The semiconductor device according to claim 17,

wherein a rate of a linear expansion of said plate is equal to that of an external substrate on which said semiconductor device is mounted, or between that of said semiconductor device and that of said external substrate.

55. The semiconductor device according to claim 18,

wherein a rate of a linear expansion of said plate is equal to that of an external substrate on which said semiconductor device is mounted, or between that of said semiconductor device and that of said external substrate.

56. The semiconductor device according to claim 19,

wherein a rate of a linear expansion of said plate is equal to that of an external substrate on which said semiconductor device is mounted, or between that of said semiconductor device and that of said external substrate.

57. The semiconductor device according to claim 20,

wherein a rate of a linear expansion of said plate is equal to that of an external substrate on which said semiconductor device is mounted, or between that of said semiconductor device and that of said external substrate.

58. The semiconductor device according to claim 21,

wherein a rate of a linear expansion of said plate is equal to that of an external substrate on which said semiconductor device is mounted, or between that of said semiconductor device and that of said external substrate.

59. A semiconductor device comprising:

a plurality of a semiconductor device stacked and mounted on an external substrate,

wherein at least the lowermost semiconductor device is a semiconductor device according to claim 2.

60. A semiconductor device comprising:
a plurality of a semiconductor device stacked and mounted on an external substrate,
wherein at least the lowermost semiconductor device is a semiconductor device according to claim 3.

61. A semiconductor device comprising:
a plurality of a semiconductor device stacked and mounted on an external substrate,
wherein at least the lowermost semiconductor device is a semiconductor device according to claim 4.

62. A semiconductor device comprising:
a plurality of a semiconductor device stacked and mounted on an external substrate,
wherein at least the lowermost semiconductor device is a semiconductor device according to claim 5.

63. A semiconductor device comprising:
a plurality of a semiconductor device stacked and mounted on an external substrate,
wherein at least the lowermost semiconductor device is a semiconductor device according to claim 6.

64. A semiconductor device comprising:
a plurality of a semiconductor device stacked and mounted on an external substrate,
wherein at least the lowermost semiconductor device is a semiconductor device
according to claim 7.

65. A semiconductor device comprising:
a plurality of a semiconductor device stacked and mounted on an external substrate,
wherein at least the lowermost semiconductor device is a semiconductor device
according to claim 8.

66. A semiconductor device comprising:
a plurality of a semiconductor device stacked and mounted on an external substrate,
wherein at least the lowermost semiconductor device is a semiconductor device
according to claim 9.

67. A semiconductor device comprising:
a plurality of a semiconductor device stacked and mounted on an external substrate,
wherein at least the lowermost semiconductor device is a semiconductor device
according to claim 10.

68. A semiconductor device comprising:

a plurality of a semiconductor device stacked and mounted on an external substrate,
wherein at least the lowermost semiconductor device is a semiconductor device
according to claim 12.

69. A semiconductor device comprising:
a plurality of a semiconductor device stacked and mounted on an external substrate,
wherein at least the lowermost semiconductor device is a semiconductor device
according to claim 13.

70. A semiconductor device comprising:
a plurality of a semiconductor device stacked and mounted on an external substrate,
wherein at least the lowermost semiconductor device is a semiconductor device
according to claim 14.

71. A semiconductor device comprising:
a plurality of a semiconductor device stacked and mounted on an external substrate,
wherein at least the lowermost semiconductor device is a semiconductor device
according to claim 15.

72. A semiconductor device comprising:
a plurality of a semiconductor device stacked and mounted on an external substrate,

wherein at least the lowermost semiconductor device is a semiconductor device according to claim 16.

73. A semiconductor device comprising:
a plurality of a semiconductor device stacked and mounted on an external substrate,
wherein at least the lowermost semiconductor device is a semiconductor device according to claim 17.

74. A semiconductor device comprising:
a plurality of a semiconductor device stacked and mounted on an external substrate,
wherein at least the lowermost semiconductor device is a semiconductor device according to claim 18.

75. A semiconductor device comprising:
a plurality of a semiconductor device stacked and mounted on an external substrate,
wherein at least the lowermost semiconductor device is a semiconductor device according to claim 19.

76. A semiconductor device comprising:
a plurality of a semiconductor device stacked and mounted on an external substrate,
wherein at least the lowermost semiconductor device is a semiconductor device according to claim 20.

77. A semiconductor device comprising:
a plurality of a semiconductor device stacked and mounted on an external substrate,
wherein at least the lowermost semiconductor device is a semiconductor device
according to claim 21.